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■

REQUIREMENTS FOR PREPARATION, ADOPTION, AND SUBMITTAL OF IMPLEMENTATION PLANS

Proposed Transportation Control Measures

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 51]

TRANSPORTATION CONTROL MEASURES

Requirements for Preparation, Adoption, and Submittal of Implementation Plans

On August 14, 1971 (36 FR 15486), the Administrator of the Environmental Protection Agency promulgated as 42 CFR Part 420 regulations for the preparation, adoption, and submittal of State implementation plans under section 110 of the Clean Air Act, as amended (hereafter referred to as the Act). Those regulations were republished November 25, 1971 (36 FR 22369), as 40 CFR Part 51, amended December 17 and December 30, 1971.

On June 20, 1972 (37 FR 12155), the Administrator of the Environmental Protection Agency published notice of rule making that proposed amendments to 40 CFR Part 51 designed to provide a clearer explanation of requirements related to compliance schedules, revisions to compliance schedules and the requirements for public hearings. It is assumed that these proposed amendments will be promulgated as published for the purpose of the below proposed amendments to 40 CFR Part 51.

The Act and the Administrator's regulations (40 CFR Part 51) require States to take steps to reduce emissions from transportation sources where necessary to attain and maintain national ambient air quality standards. Accordingly, certain States were advised on May 31, 1972 (37 FR 10842), July 27, 1972 (37 FR 15080), and on October 28, 1972 (37 FR 23085), that they would have to submit, no later than February 15, 1973, definitive transportation control plans, including identification of the specific transportation control measures to be implemented, demonstration of the adequacy of these measures for attainment and maintenance of the national standards, and a detailed timetable for obtaining any necessary legal authority and for taking of all other steps necessary to implement the various measures. The Environmental Protection Agency, in cooperation with the Department of Transportation, will provide assistance to the States in the development of their transportation control plans.

The Requirements for Preparation, Adoption, and Submittal of Implementation Plans (40 CFR Part 51) set forth regulations to be followed by the States relative to implementation plans. Except as proposed to be changed herein, those regulations are to be followed in preparation of transportation control plans. In order to fully advise States in the area of transportation control measures, it is necessary to include additional information in the requirements. The principal additions proposed as amendments are described below:

(1) Public hearings for transportation control measures are required—§ 51.4(f).

(2) Administrative and enforcement procedures for transportation control measures must be described in the transportation control plan—§ 51.14(a)(3).

(3) Transportation or other emissions control measures shall not result in an increase in the concentration of any pollutant to a level exceeding a national standard—§ 51.14(c)(1).

(4) New emission factors have been published for light- and heavy-duty gasoline powered vehicles including growth rates, vehicle miles traveled, altitude, and deterioration factors—§ 51.14(f).

(5) Transportation control measures must include procedures for monitoring emissions from transportation sources—§ 51.19(d).

(6) Additional subsections and appendixes are added to cover the following:

(a) Documentation requirements for transportation control methodology and data—§ 51.14(c)(5) and Appendix M.

(b) Estimates of emissions reductions achieved by inspection, maintenance and retrofit of in-use vehicles—§ 51.14(h)(2) and Appendix N.

The Environmental Protection Agency will promulgate transportation control measures in States that do not meet the requirements of section 110 of the Act, as stated on May 31, 1972 (37 FR 10846), or that fail to comply with the timetables for acquisition of legal authority and taking of other steps (40 CFR 52.6). In the latter case, the plans promulgated by EPA may be different from the States' plans.

The Environmental Protection Agency has published the results of an investigation of certain transportation control measures in "Prediction of the Effects of Transportation Controls on Air Quality in Major Metropolitan Areas", final report (The Six Cities Study) November 20, 1972. Additional information is contained in "Evaluating Transportation Controls to Reduce Motor Vehicle Emissions in Major Metropolitan Areas, Final Report," November 20, 1972. Both reports are available from EPA, Air Pollution Technical Information Center, Research Triangle Park, N.C. These reports may be used by a State considering such control measures as motor vehicle restrictions, work schedule changes, expanded mass transit, increased vehicle occupancy, auto-free zones, parking taxes, traffic engineering measures to improve traffic flow and land use planning. The EPA document, "Control Strategies for In-Use Vehicles," November 1972, provides information on the use of inspection, maintenance, retrofit, and gaseous fuel conversion approaches to transportation controls. This report is available from the EPA, Mobile Source Pollution Control Program, 401 M Street SW., Washington, DC 20460.

States preparing transportation control plans are encouraged to consider the relative costs and social and economic impacts of alternative control strategies. As stipulated in § 51.2 of Requirements for Preparation, Adoption, and Submittal of Implementation Plans (40 CFR Part 51), nothing in these requirements shall be construed in any manner as discouraging the consideration of such factors, in addition to air quality effects, in the development of control strategies. States are urged to provide for timely and thorough public notification of the operations and requirements of proposed transportation control measures.

States preparing transportation control plans are also urged to give special consideration to §§ 51.12(a) and 51.14(c)(1) concerning the maintenance of the national ambient air quality standards and the offsetting of emissions increases due to growth in motor vehicle traffic and other factors. Consideration should be given to the possibility that certain improvements in transportation systems (e.g., traffic flow improvements, construction of fixed-guideway mass transit facilities) may stimulate gradual increases in motor vehicle traffic and, consequently, in emissions from transportation sources. Transportation control plans should include provisions as necessary to prevent such emissions increases from leading to pollutant concentrations that exceed the national ambient air quality standards.

Interested persons may participate in this rule making by submitting written comments in triplicate to the EPA, Land Use Planning Branch, Office of Air Quality Planning and Standards, Research Triangle Park, N.C. 27711. All relevant comments received not later than 30 days after the date of publication of this notice will be considered. Receipt of comments will be acknowledged, but substantive responses to individual comments will not be provided. Comments received will be available for public inspection during normal business hours at the Office of Public Affairs, 401 M Street SW., Washington, DC 20460. The changes proposed by this notice, with appropriate modification, will be effective upon republication in the FEDERAL REGISTER. This notice of proposed rule making is issued under the authority of section 301(a) of the Clean Air Act (42 U.S.C. 1857 et seq.).

Dated: January 5, 1973.

WILLIAM D. RUCKELSHAUS,
Administrator,
Environmental Protection Agency.

Part 51 of Title 40, Code of Federal Regulations is proposed to be amended as follows:

1. In § 51.1, new paragraphs (r), (s), (t), (u), (v), (w), and (x) are added as follows:

§ 51.1 Definitions.

* * * * *

(r) "Transportation Control Measure" means any measure, such as reducing vehicle use, changing traffic flow patterns, or decreasing emissions from individual motor vehicles, that is directed toward reducing emissions of air pollutants from transportation sources.

(s) "Vehicle Trip" means any movement of a motor vehicle from one location to another that results in the emission of air pollutants by the motor vehicle.

(t) "Trip Type" means any class of vehicle trips possessing one or more characteristics (e.g., work, nonwork; peak, offpeak; freeway, nonfreeway) that distinguish vehicle trips in the class from vehicle trips not in the class.

(u) "Vehicle type" means any class of motor vehicles (e.g., precontrolled, heavy duty vehicles, gasoline powered trucks) whose emissions characteristics are significantly different from the emissions characteristics of motor vehicles not in the class.

(v) "Traffic flow measure" means any measure, such as signal light synchronization, freeway metering and curbside parking restrictions, that is taken for the purpose of improving the flow of traffic and thereby reducing emissions of air pollutants from motor vehicles.

(w) "Roadway type" means any class of roadway facility that can be broadly categorized as to function and assigned average speed and capacity values, e.g., expressway, arterial, collector, and local.

(x) "Time period" means any period of time designated by hour, month, season, calendar year, averaging time, or other suitable characteristics, for which ambient air quality is estimated.

2. In § 51.4, paragraph (f) is added as follows:

§ 51.4 Public hearings.

* * * * *

(f) The State shall, prior to adoption of transportation control measures deferred beyond the statutory deadline for submittal of implementation plans, conduct one or more public hearings as required in paragraphs (a) through (d) of this section.

3. In § 51.5, paragraphs (d) and (e) are added as follows:

§ 51.5 Submission of plans; preliminary review of plans.

* * * * *

(d) Submission to the Administrator shall be accomplished by delivering 10 copies of the transportation control portions of the plan to the appropriate regional office. Such portions shall be adopted by the State and submitted by the Governor.

(e) Upon request of a State, the Administrator will provide preliminary review of the draft transportation control measures or portions thereof in advance of the date such measures are due. Such requests shall be made as provided in paragraph (c) of this section and shall not operate to relieve a State of its responsibility for adopting and submitting transportation control measures in accordance with prescribed due dates.

4. In § 51.14, paragraph (a)(3) is added, paragraphs (c)(1) and (c)(5) are revised, and paragraphs (f), (g), and (h) are added. As amended, § 51.14 reads as follows:

§ 51.14 Control strategy: Carbon monoxide, hydrocarbons, photochemical oxidants, and nitrogen dioxide.

* * * * *

(a) * * *

(3) The plan shall contain:

(i) A description of enforcement methods including, but not limited to, procedures for monitoring compliance with the selected traffic control measures, procedures for handling violations, and a designation of enforcement responsibilities (i.e., air pollution control agency, State police).

(ii) Proposed or adopted rules and regulations pertaining to the selected transportation control measures.

(iii) A description of administrative procedures to be used in implementing all selected transportation control measures.

(iv) A schedule designating dates by which legal authority necessary to implement the plan will be obtained, other significant steps in the implementation of the plan will be achieved, and each control measure will be implemented.

* * * * *

(c) *Adequacy of control strategy* (1) The plan shall demonstrate, by means of a proportional model or diffusion/photochemical model or other procedure which is adequate and appropriate, that the control strategy included in each plan for a region classified as priority I is adequate for attainment and maintenance of the national standard(s) to which such control strategy applies. Control measures shall not result in an increase in the concentration of any pollutant to a level that exceeds a national ambient air quality standard. The plan shall include provisions as necessary to prevent such increases in concentrations as a result of traffic increases that may be stimulated by transportation control measures.

* * * * *

(5) The plan shall show that the control strategy including transportation control measures will result in the degree of emissions reduction indicated to be necessary by a proportional model, diffusion model, or other procedure which is adequate and appropriate. The plan shall contain a summary of the computations, assumptions, and judgments used to determine the emissions reductions that will result from application of the control strategy to each point source, and each group of area sources. Such summary shall be included in a table similar to that presented in Appendix D to this part. The plan also shall contain a summary of the data, computations, assumptions, and judgments used to develop any transportation control measures that are a part of the control strategy. Such a summary shall as a minimum contain the material described in Appendix M to this part. The detailed computations and data shall be retained by the State and made available for inspection by the Administrator at his request.

* * * * *

(f) *Motor vehicle emission factors.* The States required to submit transportation control plans must, except as noted below, use current emission factors and methodology to calculate emissions from gasoline powered motor vehicles. The current emission factors and methodology are presented in "Compilation of Air Pollutant Emission Factors," EPA report No. AP-42, revised semiannually, and in superseding EPA interim reports. These are available from the EPA, Office of Air Quality Planning and Standards, Research Triangle Park, N.C. 27711. If emissions other than those presented in the EPA report are used, the substantiating justification must be submitted with the transportation control measures.

(g) *Air quality baseline.* The concentrations of carbon monoxide and photochemical oxidants set forth in the State plan as approved and promulgated on May 31, 1972 (37 FR 10842) (40 CFR Part 52), should be used as the air quality baselines for computation of the emissions reductions through transportation control measures required to meet national standards. More recent air quality data may be used where adequate and appropriate. However, such data must be compatible with the emissions inventory for the region involved and justification submitted for the appropriateness of its use. Revised air quality data should be submitted to the appropriate EPA regional office at the earliest possible date for evaluation and approval to preclude plan disapproval resulting from the use of faulty air quality data.

(h) *Transportation control strategies.* Information and requirements for States which are considering transportation control measures involving inspection, maintenance and retrofit of in-use motor vehicles are presented in Appendix N to this part.

5. In § 51.19, paragraph (d) is added as follows:

§ 51.19 Source surveillance.

* * * * *

(d) Procedures for obtaining and maintaining data on actual emissions reductions achieved as a result of implementing transportation control measures. In the case of measures involving inspection, maintenance, or retrofit, these data shall include the results of an emission surveillance program designed to determine actual average per vehicle emissions reductions attributable to inspection, maintenance and/or retrofit. In the case of measures based on traffic flow changes or reductions in vehicle use, the data shall include observed changes in vehicle miles traveled (VMT) and average speeds. The data shall be maintained in such a way as to facilitate comparison of the planned and actual efficacy of the transportation control measures.

6. In this part, Appendix M is added as follows:

APPENDIX M—TRANSPORTATION CONTROL SUPPORTING DATA SUMMARY

When transportation control measures of any type are to be imposed, the plans shall

contain a summary of the data, computations, and rationale used to develop the transportation control measures that will result in the required reduction of emissions. Such a summary shall, as a minimum, contain the material described below. Suggested procedures for obtaining and coding information about air pollutant emissions from stationary and mobile sources have been published.[1] The detailed computations and data shall be retained by the State agency and made available for inspection by the Administrator at his request.

1. The transportation control plan shall display total emissions of hydrocarbons (HC), carbon monoxide (CO), and nitrogen oxides (NOx), subdivided into emissions from mobile and stationary sources, that will occur with and without implementation of the transportation control measures in each region or subregion and time period in which a proportional or other air quality model is used to determine air quality. These data shall be projected for at least 5 years in 1-year intervals starting with the year in which the national ambient air quality standards are to be achieved. The data shall be displayed in a format similar to table 1.

2. If the transportation control measures, either in their application or their effect, distinguish between trip types or vehicle types, the transportation control plan shall display vehicle miles traveled and emissions of HC, CO, and NO_x due to each trip type or vehicle type that will occur with and without implementation of the transportation control measures in each region or subregion and time period in which a proportional or other air quality model is used to determine air quality levels. A strategy that results in different percent emission reductions of HC, CO, or NOx for different trip or vehicle types should distinguish between trip or vehicle types in its effect. The data shall be displayed in a format similar to table 2.

3. If the transportation control measures include traffic flow measures, the transportation control plan shall display average speeds and vehicle miles traveled according to roadway type (freeway, arterial, local/collector) that will occur with and without implementation of the transportation control measures in each region or subregion and time period in which proportional or other air quality model is used to determine air quality levels. The plan shall also display emissions of HC, CO, and NO_x from mobile sources, subdivided according to roadway type, that will occur with and without implementation of the transportation control measures in each region or subregion and time period in which a proportional or other air quality model is used to determine air quality. The data shall be displayed in a format similar to table 2.

4. If the effectiveness of the transportation control measures depends in whole or in part on voluntary public response to changes in prices or taxes, mass transit improvements, or other incentives or disincentives affecting vehicle emissions, travel frequency, mode, location, time of day or other characteristics of travel demand, the transportation control plan shall display the demand elasticities or other appropriate quantitative measures of public response to such incentives or disincentives that were used to evaluate the effects on emissions of the incentives or disincentives. The sources of these elasticities or other quantitative measures shall be described.

5. The sources of all traffic data, such as vehicle miles traveled and speeds by trip type, vehicle type, and roadway type, used in evaluating the effects upon air quality of the transportation control measures shall be described in the transportation control plan.

6. The assumptions, judgments and computations used to develop the information in items 1 through 4 above shall be summarized in the transportation control plan.

A transportation control plan that fails to include any element of data required by this appendix will be acceptable only if the plan presents the data and analytic procedures used to estimate the effects on air quality of the selected transportation control measures and provides adequate justification for the use of such data and procedures.

TABLE 1

The data required by paragraph 1 above shall be displayed in a table similar to the following:

Emissions*

	Mobile		Stationary	
	With transportation control measures	Without transportation control measures	With transportation control measures	Without transportation control measures
Time period 1:				
Subregion 1				
Subregion 2				
Do.				
Do.				
Do.				
Time period 2:				
Subregion 1				
Subregion 2				
Do.				
Do.				
Do.				
Other time periods as needed:				
Subregion 1				
Subregion 2				
Do.				

* Indicate pollutant.

TABLE 2

The data required by paragraphs 2 and 3 above shall be displayed in a table similar to the following:

Subregion_____

Time period_____

Emissions[1] (or VMT or speeds)[2]

Trip type and roadway type	Vehicle type—1		Vehicle type—2		Continue with other vehicle types as appropriate
	With transportation control measures	Without transportation control measures	With transportation control measures	Without transportation control measures	
Work:					
Freeway					
Arterial					
Collector					
Local					
Shopping:					
Freeway					
Arterial					
Collector					
Local					

[1] Indicate pollutant.

[2] The table need contain only those entries appropriate to the transportation control measures included in the plan.

NOTE: Continue with other trip types as appropriate.

7. In this part, Appendix N is added as follows:

APPENDIX N—EMISSIONS REDUCTIONS ACHIEVABLE THROUGH INSPECTION, MAINTENANCE AND RETROFIT OF LIGHT DUTY VEHICLES

1. *General.* This appendix presents estimates of emissions reductions that, in the judgment of the Administrator, are likely to be achievable through application of inspection, maintenance, and retrofit measures to in-use motor vehicles. To the extent possible, these estimates are based on empirical data. However, lack of data in some areas has necessitated some extrapolation of empirical data using engineering judgment. The sources of empirical data and the bases for judgments are discussed in paragraph 6 of this appendix.

The emissions reductions estimates presented herein are subject to considerable uncertainty. The emissions reductions actually realized in a transportation control program may be greater or less than the estimated reductions. The estimates should therefore be regarded as useful primarily for current planning purposes. Any transportation control plan incorporating in-use vehicle emission control approaches, whether those specifically cited in this appendix or alternatives proposed by a State, must provide, as required by 40 CFR 51.19d, for field verification of the emissions actually achieved in the implemented programs and, as required by section 110(a)(2)(H) of the Act, for any revisions of the transportation control plan that may be indicated thereby.

The approaches to in-use vehicle emissions control cited herein are those judged to be most generally applicable by the Administrator considering the information currently available to him. States are encouraged to consider other approaches that may be applicable to their particular situations. Data

[1] Environmental Protection Agency, A Guide for Compiling a Comprehensive Emission Inventory, APTD–1135, June 1972, Available from Air Pollution Technical Information Center, EPA, Research Triangle Park, N.C. 27711.

and analyses supporting the emissions reductions claimed for alternative approaches must be submitted with the transportation control plan. Several alternative approaches are discussed in a report entitled "Control Strategies for In-use Vehicles," available from EPA, Mobile Sources Pollution Control Program, 401 M Street SW., Washington, DC 20460.

States proposing inspection/maintenance or retrofit programs are encouraged to consider the effects on the implementation of their plans of inequities that may arise in connection with these programs. Such inequities may include premature failure or inadequacy of retrofit components, improper or inadequate workmanship at inspection and repair facilities, inconvenient numbers, locations, and operating schedules for inspection, retrofit, and repair facilities, and inadequate public notice of inspection maintenance and retrofit requirements.

The States are also encouraged to give consideration to transportation control measures based on reductions in vehicle use and traffic flow measures. Nothing in this appendix is intended to suggest that transportation control approaches based on inspection, maintenance, and retrofit should necessarily be considered preferable to approaches based on reductions in vehicle use or traffic flow measures.

2. *Definitions.* a. "Precontrolled vehicles" means light duty vehicles sold nationally (except in California) prior to 1968 model year and light duty vehicles sold in California prior to the 1966 model year.

b. "Controlled vehicles" means light duty vehicles sold nationally (except in California) in the 1968 model year and later and light duty vehicles sold in California in the 1966 model year and later.

c. "Loaded emissions test" means a sampling procedure for exhaust emissions which requires exercising the engine under stress (i.e., "loading") by use of a dynamometer to stimulate actual driving conditions.

d. "Idle emission test" means a sampling procedure for exhaust emissions which requires operation of the engine in the idle mode only.

e. "Retrofit" means the addition or removal of an item of equipment, or a required adjustment, connection, or disconnection of an existing item of equipment, for the purpose of reducing emissions.

f. "Inspection/maintenance" means a program to reduce emissions from in-use vehicles through identifying vehicles that need emissions control related maintenance and requiring that maintenance be performed.

g. "Idle adjustments" means a series of adjustments which include idle RPM, idle air/fuel ratio and basic timing.

3. *Inspection/maintenance of light duty vehicles.* (a) Reductions:

The following average annual reductions in exhaust emissions per vehicle are estimated to be achievable through implementation of an inspection/maintenance program using a loaded emission test:

	Percent
Hydrocarbons	12
Carbon Monoxide	10
Nitrogen Oxides	0

To obtain these reductions an inspection/maintenance program must provide for inspection of each vehicle at least once per year. More frequent inspection and maintenance is expected to provide larger average emissions reductions, although at greater cost. During the first inspection cycle of an inspection/maintenance program, emissions reductions may be assumed only to the extent consistent with the portion of the vehicle population that has been inspected by that time.

b. The average reductions cited above are applicable for all gasoline-powered light duty motor vehicles (except motorcycles) which are included in the inspection/maintenance program.

c. Requirements:

An acceptable inspection/maintenance program must include:

(i) Provisions for regular periodic inspection of all vehicles for which emissions reductions are claimed.

(ii) Provisions for the establishment of inspection failure criteria consistent with the claimed reductions.

(iii) Provisions to ensure that failed vehicles receive the maintenance necessary to achieve compliance with the inspection standards. This might include sanctions against individual owners or repair facilities, retest of failed vehicles following maintenance, a certification program to insure that repair facilities performing the required maintenance have the necessary equipment, parts and knowledge to perform the tasks satisfactorily, and/or other measures.

(iv) A program of enforcement to insure that vehicles are not intentionally readjusted or modified subsequent to the inspection and/or maintenance in such a way as would cause them to no longer comply with the inspection standards. This might include spot checks of idle adjustments and/or a suitable type of physical tagging.

d. Alternative approaches:

Inspection/maintenance programs employing approaches other than emissions testing using a loaded emissions test may be capable of achieving emissions reductions for vehicles of certain model years. Idle emissions inspection, extensive engine parameter inspection, and mandatory maintenance procedures are discussed in the Environmental Protection Agency report "Control Strategies for In-Use Vehicles." Inspection/maintenance approaches other than those using a loaded emissions test, or emissions reductions greater than those cited in paragraph 3.a using a loaded emissions test, will be acceptable only if sufficient data are provided to justify the emissions reductions claimed.

4. *Retrofit of light duty vehicles*—(a) *Reductions.* The following reductions in exhaust emissions per vehicle are estimated to be achievable through installation of specific classes of retrofit devices on the specific model year classes of vehicles noted. Since retrofitted vehicles are expected to be subject to periodic inspection and maintenance (see Paragraph 4.2), the reductions cited are to be applied to a maintained vehicle emissions baseline. For example, if a 12 percent reduction in hydrocarbon emissions is claimed for inspection/maintenance, the reduction in hydrocarbon emissions due to a retrofit approach should be calculated after the vehicle's original emission rate for hydrocarbons has been reduced by 12 percent.

(i) Pre-controlled vehicles:

[In percent]

Retrofit option	Average reduction per vehicle		
	HC	CO	NO_x
Lean idle air/fuel ratio adjustment and vacuum spark advance disconnect	25	9	23
Oxidizing catalytic converter and vacuum spark advance disconnect	68	63	48
Air bleed to intake manifold	21	58	0
Exhaust gas recirculation and vacuum spark advance disconnect	12	31	48

(ii) Controlled vehicles.

[In percent]

Retrofit option	Average reduction per vehicle		
	HC	CO	NO_x
Oxidizing catalytic converter	50	50	0
Exhaust gas recirculation	0	0	40
Oxidizing catalytic converter and exhaust gas recirculation	50	50	40

During the installation phase of a retrofit program, emissions reductions may be assumed only to the extent consistent with the portion of the vehicle population on which retrofit devices have been installed by that time.

(b) *Applicability.* The emissions reductions cited above for precontrolled vehicles are applicable to all gasoline-powered light duty motor vehicles (except motorcycles) sold nationally (except in California) prior to the 1968 model year or in California prior to the 1966 model year.

The emissions reductions cited above for installation of oxidizing catalytic converters on controlled vehicles are applicable to all gasoline-powered light duty motor vehicles (except motorcycles) sold nationally (except in California) in the 1968 through 1974 model years or in California in the 1966 through 1974 model years.

The emissions reductions cited above for installation of exhaust gas recirculation on controlled vehicles are applicable to all gasoline-powered light duty motor vehicles (except motorcycles) sold nationally (except in California) in the 1968 through 1972 model years or in California in the 1966 through 1971 model years.

(c) *Requirements.* An acceptable retrofit program must include:

(i) A method of ensuring that personnel installing the retrofits have the knowledge required to perform the needed tasks satisfactorily and have an adequate supply of retrofit components and that these components will be capable of achieving the claimed reductions.

(ii) Provisions for emissions testing at the time of retrofit installation or some other positive assurance that the retrofit device is installed and operating correctly.

(iii) Provisions for inspection of each retrofitted vehicle at least once per year.

(iv) Provisions for the establishment of inspection standards for retrofitted vehicles consistent with the emissions reductions claimed. Particular attention must be paid in this regard to catalytic converter retrofits as the reductions cited in paragraph 4.a do not include possible irreversible catalyst deterioration over time.

(v) Provisions to ensure that vehicles failing inspection receive the maintenance necessary to achieve compliance with the inspection standards.

(vi) In the case of retrofit programs that include the use of catalytic converters requiring unleaded fuel, provisions to ensure that vehicles utilizing this type of retrofit will not use leaded gasoline and that adequate supplies of lead-free gasoline will be available if Federal regulations will not insure availability, and provided that such provisions are not in violation of section 211(c)(4) of the Act.

(d) *Alternative approaches.* Retrofit programs employing approaches other than those cited above may be capable of achieving emissions reductions for vehicles of certain model years. For example, addition of vacuum spark advance disconnect to the air bleed to intake manifold approach may be feasible for precontrolled vehicles. Alternative retrofit approaches or retrofit emissions reductions

greater than those cited in paragraph 4.a will be acceptable only if sufficient data and analyses are provided to justify the emissions reductions claimed.

5. *Inspection/maintenance or retrofit of vehicles other than light duty vehicles.* The inspection/maintenance and retrofit approaches discussed above may be applicable to certain clauses of motor vehicles other than those cited. In particular, the States are encouraged to consider the application of such approaches to motor vehicles in the 6,000 to 10,000 lb. GVW class. In many cases, these vehicles are constructed and operated in a manner similar to light-duty vehicles. However, the present lack of test data for application of inspection/maintenance or retrofit approaches to vehicles of this type prevents the inclusion of data on achievable emissions reductions for such vehicles in this appendix. Transportation control strategies employing inspection/maintenance or retrofit of vehicles other than light-duty vehicles will be acceptable only if sufficient data and analyses are provided to justify the emissions reductions claimed.

6. *Bases for emissions reductions cited in paragraphs 3 and 4*—(a) *Inspection/maintenance.* The reductions cited in paragraph 3.a for inspection/maintenance using a loaded emissions test were derived from test data obtained by EPA in evaluating the initial emissions reductions achieved when a fleet of precontrolled and controlled light duty vehicles are subjected to a loaded emissions inspection test and the vehicles failing that test were serviced in private maintenance garages. The results of that study are presented in the EPA report, "Control Strategies for In-Use Vehicles." The observed average initial reductions were 25 percent (HC), 19 percent (CO), and 0 percent (NOx).

It is expected that in an actual inspection/maintenance program the average emissions reductions achieved will be substantially less than the initial reductions observed in the study, since there will be deterioration of emissions-related components and adjustments between periodic inspection and maintenance events. While the currently available data on such deterioration are inadequate to accurately predict the consequences of this effect, some correction for deterioration is necessary. Therefore, giving consideration to the current frequency of voluntary maintenance and the emissions reductions typically achieved by existing maintenance procedures, it has been assumed that linear deterioration to before-maintenance emissions levels will occur over the 12-month period following maintenance. As a result, the average effectiveness for annual inspection is estimated to be one-half of the initial effectiveness following maintenance.

Data on the effectiveness of inspection/maintenance programs in reducing emissions are available only for light duty vehicles through the 1971 model year. The effectiveness of inspection/maintenance programs in reducing emissions from future model year vehicles will depend primarily on the extent to which emissions from those vehicles increase in use as a result of repairable malfunctions and on the ability of the inspection test to accurately identify vehicles having such malfunctions. These factors can be evaluated only after substantial numbers of such vehicles have been in use for some time. However, for implementation planning purposes, it has been assumed that emissions reductions estimated to be achievable for current light duty vehicles will be applicable for future model years as well.

Available data indicate that initial emissions reductions attainable through inspection/maintenance programs using an idle mode emissions test, are comparable to those attainable when a loaded emission test is used. However, it is anticipated that, in practice, programs based on an idle mode test only, will be substantially less effective than these data suggest. This is because only limited maintenance (in contrast to the extensive maintenance performed in the loaded emissions tests) is generally required in achieve compliance with an idle emissions test. Such maintenance may not achieve improvements in true mass emissions under typical driving conditions. Furthermore, an idle mode test alone can often be satisfied with combinations of engine adjustments that accomplish little or no true emissions reductions in terms of emissions measured over a driving cycle representative of typical urban driving conditions (the Federal Certification Test Procedure). Quantitative estimates of the loss in emissions reduction effectiveness due to these effects are not presently available.

Inspection and maintenance programs using engine parameter inspection or mandatory maintenance approaches may also be effective for vehicles of certain model years. However, such approaches must be tailored to relate to the specific engine and emissions control systems of the vehicles to be inspected and/or maintained. Depending upon inspection and maintenance procedures and the number and choice of engine parameters included in the program, substantial variations in emissions reductions are to be expected.

Because of the above considerations, it has been concluded that generally applicable estimates of achievable emissions reductions can be derived from currently available data only for programs which use a loaded emissions test. States considering inspection and/or maintenance programs based on alternative approaches should take the factors mentioned above into account where estimating and justifying emissions reductions expected from such programs. More detailed discussion of these matters may be found in the EPA report "Control Strategies for In-Use Vehicles."

(b) *Retrofit*—(i) *Pre-controlled vehicles.* The reductions cited in paragraph 4.a for precontrolled vehicles are based upon test data obtained in evaluating the initial emissions reductions obtained when various types of retrofit emissions control systems were fitted to fleets of tuned precontrolled light duty vehicles. The results of these studies are presented in the EPA "Control Strategies for In-Use Vehicles." In each case, the mean emissions reductions observed have been adopted as being most representative of the initial emissions reductions which may be achieved in an actual retrofit program.

Only very limited data are currently available on the deterioration of emissions performance of retrofit vehicles. These data, which are discussed in the EPA report "Control Strategies for In-Use Vehicles," indicate the need for periodic inspection and maintenance of retrofitted vehicles if the attainment and maintenance of the retrofit emissions reductions cited in paragraph 4.a is to be assured. Based upon the available data and the requirements for inspection and maintenance of retrofitted vehicles at least once per year, and considering the nature of the emissions control techniques employed in each retrofit approach, it appears that the average annual emissions reductions per retrofitted vehicle can approach the observed mean initial reductions if suitable inspection and maintenance criteria are adopted. Accordingly, it has been assumed for planning purposes that the observed initial emissions reductions will not be affected by deterioration.

(ii) *Controlled vehicles.* Data which could serve as a basis for estimating emissions reductions achievable through retrofitting controlled light duty vehicles are quite limited. As a result, the emissions reductions cited for this class of vehicles in paragraph 4.a were developed by extrapolating the data for retrofitting precontrolled light-duty vehicles.

The techniques of lean idle air/fuel ratio adjustment, vacuum spark advance disconnect, and air bleed to intake manifold are not considered to be generally applicable to controlled vehicles. This is because these emissions control approaches are either incorporated into or may be inconsistent with emissions control techniques already applied to many controlled vehicles.

Exhaust gas recirculation (EGR) is considered generally applicable only to those vehicles not substantially controlled for nitrogen oxides emissions. Therefore, EGR as a retrofit approach is applicable in 1968 through 1972 models sold nationwide (outside of California), except for an insignificant number of 1972 vehicles already equipped with EGR. Incorporation of EGR into a significant number of 1972 models sold in California limits the general applicability of this retrofit approach to 1966 through 1971 controlled vehicles sold in California.

Oxidizing catalytic converters are considered to be potentially applicable as retrofits through the 1974 model year. Beyond the 1974 model year, the presently anticipated design of emissions control systems required to meet Federal new car emissions standards is considered to preclude retrofitting using currently available retrofit technology.

The following paragraphs describe the bases for the emissions reductions cited for retrofit of controlled vehicles.

Oxidizing catalytic converters. Test data indicate that catalytic converter retrofits to precontrolled vehicles can achieve emissions reductions of 68 percent (hydrocarbons), 63 percent (carbon monoxide), and 48 percent (nitrogen oxides) when combined with vacuum spark advance disconnect. Presently available data suggest that deterioration may not be significant with retrofit-type catalysts.

Experience to date with prototype 1975 emissions control systems suggests that retrofit catalytic converters are capable of achieving substantial reductions of hydrocarbon and carbon monoxide emissions from controlled light-duty vehicles. While studies of precontrolled vehicles have provided evidence that retrofit catalysts may also achieve some reduction of nitrogen oxides emissions, the extent of this reduction is too highly dependent on the air/fuel ratio in the catalyst to be extrapolated to controlled vehicles with reasonable certainty.

In experiments conducted to date, installation of retrofit catalysts on precontrolled vehicles has been accompanied by vacuum spark advance disconnect. In addition, a lean idle air/fuel ratio adjustment has normally been included in the installation procedures. As neither of the latter two modifications is generally applicable to controlled vehicles, it is prudent to anticipate that reductions of hydrocarbon and carbon monoxide emissions achieved by retrofit catalysts on controlled vehicles may be less than those observed with precontrolled vehicles.

The cited emissions reductions of 50 percent (hydrocarbons), 50 percent (carbon monoxide), and 0 percent (nitrogen oxides) are estimates consistent with the foregoing considerations and the results obtained with precontrolled vehicles.

Exhaust Gas Recirculation (EGR). Emissions reductions of 12 percent (hydrocarbons), 31 percent (carbon monoxide), and 48 percent (nitrogen oxides) have been observed as a result of retrofitting precontrolled

light duty vehicles with EGR accompanied by vacuum spark advance disconnect. Experience with 1973 emissions control systems for new cars suggests that EGR retrofits can achieve substantital reductions of nitrogen oxides emissions from controlled vehicles not already equipped with EGR or equivalent nitrogen oxides emissions control systems.

Much of the hydrocarbon control and some of the nitrogen oxides control observed with EGR retrofits to precontrolled vehicles is attributable to the vacuum spark advance disconnect. This is not generally applicable to controlled vehicles. In addition, the design features responsible for much of the carbon monoxide reduction observed with precontrolled vehicles are likely to be already incorporated into many controlled vehicles. It is therefore prudent to expect that EGR retrofits to controlled vehicles may achieve somewhat smaller reductions of nitrogen oxides emissions than have been observed with precontrolled vehicles and no reductions of hydrocarbon and carbon monoxide emissions.

The cited emissions reductions of 0 percent (hydrocarbons and carbon monoxide) and 40 percent (nitrogen oxides) are estimates consistent with the foregoing considerations and the results obtained with precontrolled vehicles.

EGR and oxidizing catalytic converter retrofit for controlled vehicles affect different pollutants and operate independently on different parts of the engine. Therefore, when the two retrofits are combined, the emissions reductions obtained from each can be considered additive.

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